



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 15.6.4 RADIOLOGICAL CONSEQUENCES OF MAIN STEAM LINE FAILURE OUTSIDE CONTAINMENT (BWR)

REVIEW RESPONSIBILITIES

Primary - Accident Evaluation Branch (AEB)

Secondary - Reactor Systems Branch (RSB)

I. AREAS OF REVIEW

The purpose of the review is to calculate the whole body and thyroid doses resulting from a postulated failure of a main steam line outside containment of a BWR facility, and to assure that radioactive releases due to the failure are adequately limited by the technical specifications on primary coolant activity. The review includes two cases for the reactor coolant iodine concentration: (1) with a preaccident iodine spike, and (2) with the maximum equilibrium concentration for continued full power operation.

A secondary review is performed by the Reactor Systems Branch (RSB). The amount of potential fuel failure resulting from the postulated main steam line break (MSLB) accident is routinely evaluated by RSB and the result provided to the AEB for consideration in the evaluation of the MSLB radiological consequences.

The review of the applicable technical specifications is coordinated with and performed by the Licensing Guidance Branch as part of its primary review responsibility for SRP Section 16.0. The acceptance criteria necessary for the review and the method of application are contained in SRP Section 16.0.

II. ACCEPTANCE CRITERIA

The acceptance criteria are based on the requirements of 10 CFR Part 100 as related to the radiological consequences of an accident. The plant site and the dose mitigating engineered safety features (ESF) are acceptable with respect to the radiological consequences of a postulated MSLB outside containment of a BWR facility if the calculated whole body and thyroid doses at the exclusion area and the low population zone boundaries do not exceed the following exposure guidelines:

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USNRC STANDARD REVIEW PLAN

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

1. For a MSLB with an assumed preaccident iodine spike corresponding to the maximum iodine concentration stated in the NSSS vendor standard technical specifications, the calculated doses should not exceed the guideline values of 10 CFR Part 100, paragraph 11 (Ref. 1).
2. For a MSLB with an assumed iodine concentration corresponding to the equilibrium value for continued full power operation stated in the NSSS vendor standard technical specifications, the doses should not exceed a small fraction of the above guideline values, i.e., 10 percent or 2.5 rem and 30 rem respectively, for the whole body and thyroid doses.
3. The methodology and assumptions for calculating the radiological consequences should reflect the regulatory positions of Regulatory Guide 1.5 (Ref. 2) except for the atmospheric dispersion factors which are reviewed under SRP Section 2.3.4.
4. A plant specific technical specification is required for both cases of iodine activity in the primary coolant. This specification is acceptable if the calculated potential radiological consequences from the MSLB accident are within the exposure guidelines for the above two cases.

III. REVIEW PROCEDURES

The reviewer selects and emphasizes specific aspects of this Standard Review Plan (SRP) section as appropriate for a particular plant. The judgment which areas need to be given attention and emphasis in the review is based on a determination if the material presented is similar to that recently reviewed on other plants and whether items of special safety significance are involved.

At the construction permit (CP) stage, the review is limited to a survey of the pertinent portions of the plant design and the applicant's discussion of the accident to determine that there are no unusual features that would prevent limitation of doses to acceptable levels by appropriate limits on coolant activity concentrations. Standard technical specifications regarding coolant activity concentration limits have been issued for BWR plants and the radiological consequences of a steam line failure have been evaluated for a standard GESSAR plant using this activity limit to determine the limiting atmospheric dispersion factors (X/Q values). Consequently, the radiological consequences of a steam line failure accident need not be explicitly calculated for a standard GESSAR plant located at a site where the X/Q value is equal to or less than the limiting X/Q value.

The detailed review of the radiological consequences of a main steam line failure outside containment is done at the operating license (OL) stage when system parameters and accident analysis are fully developed. The review at the OL stage consists of the following steps:

1. Review of the applicant's description and dose analysis of the steam line failure accident.
2. Performance of an independent analysis by the staff of the radiological consequences of the failure of the main steam line, using the assumptions of Regulatory Guide 1.5 (Ref. 2), except for the atmospheric dispersion factors. The following conservative assumptions are used to simplify the analysis:

- a. The mass of reactor coolant assumed to be released to the environment is 140,000 pounds for the "GESSAR 251" sized BWR and 100,000 pounds for the "GESSAR 238" sized BWR. Other BWRs should be evaluated on a case-by-case basis. The release is assumed to occur instantaneously. These assumptions are made unless notified otherwise by RSB.
- b. The iodine concentration in the primary coolant is assumed to correspond to the following two cases in the NSSS vendor's standard technical specifications:
 - (1) the concentration is the maximum value permitted and corresponds to the conditions of an assumed preaccident spike; and
 - (2) the concentration is the maximum equilibrium value permitted for continued full power operation.

As a result of the MSLB accident, fuel failures can occur releasing fission products into the reactor coolant and thus, making additional activity available for release to the atmosphere. The RSB reviews the effects of the MSLB on the core thermal margins and the associated amount of fuel failures. RSB, as a secondary review branch, will inform the AEB of the fuel failure estimate. If the MSLB accident is predicted to cause such fuel failure, a dose analysis will be performed with the corresponding iodine activity. No decontamination factor or other reductions in the concentrations are assumed in the staff's analysis.

- c. The appropriate atmospheric dispersion factors (X/Q values) for the staff's independent dose analysis will be determined by the assigned meteorologist in accordance with SRP Section 2.3.4.
3. Comparison of the doses calculated by the applicant and the staff for the two iodine concentrations discussed above with the appropriate acceptance criteria in subsection II of this SRP section. If the doses calculated by the staff exceed those of the exposure guidelines, then the staff will reduce the primary coolant iodine concentration limits in the plant specific technical specification accordingly.

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided by the applicant and that the applicant's analysis and the staff's independent calculations support conclusions of the following type, to be included in the staff's safety evaluation report at the operating license stage:

The staff concludes that the distances to the exclusion area and low population zone outer boundaries for the (insert PLANT NAME) site, in conjunction with the operation of the dose mitigating ESF systems, are sufficient to provide reasonable assurance that the calculated radiological consequences of a postulated main steam line failure outside the containment of the (insert PLANT NAME) station do not exceed (a) the exposure guidelines as set forth in 10 CFR Part 100 paragraph 11 for the case that the failure occurs with a preaccident iodine spike, and (b) 10 percent of these exposure guidelines for the

case that the failure occurs with a primary coolant activity corresponding to the maximum equilibrium concentration for continued full power operation as stated in the standard technical specifications for the (insert NSSS VENDOR) design. The staff will review the (insert PLANT NAME) specific technical specifications to assure that the dose guidelines stated above are not exceeded. The results of the staff's calculations are listed in Table 15.____.

This conclusion is based on (1) the staff review of the applicant's analysis of the radiological consequences, (2) the independent dose calculation by the staff using appropriate regulatory positions of Regulatory Guide 1.5 and conservative atmospheric dispersion factors as discussed in Chapter 2 of this report, and (3) the (insert NSSS VENDOR) standard technical specification for the iodine concentration in the reactor coolant consisting of a maximum allowable limit and a limit for the equilibrium concentration for continued plant operation.

At the construction permit stage, the following paragraph is included in the staff's safety evaluation report:

On the basis of our experience with the evaluation of steam line failure accidents for boiling water plants of similar design, we have concluded that the consequences of these accidents can be controlled by limiting the permissible primary coolant radioactivity concentrations so that potential offsite doses are small. We will include appropriate limits on the primary coolant activity concentrations in the technical specifications.

V. IMPLEMENTATION

The following provides guidance to applicants and licensees regarding the staff's plans for using this SRP Section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guide.

VI. REFERENCES

1. 10 CFR Part 100, Paragraph 11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance."
2. Regulatory Guide 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors."